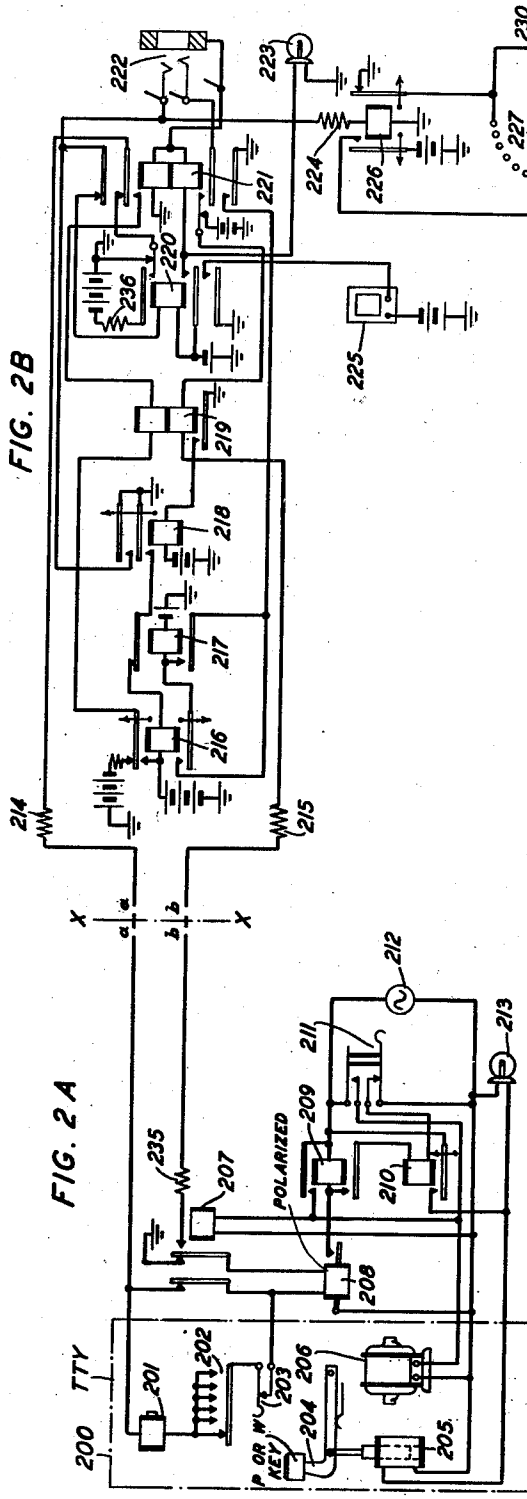
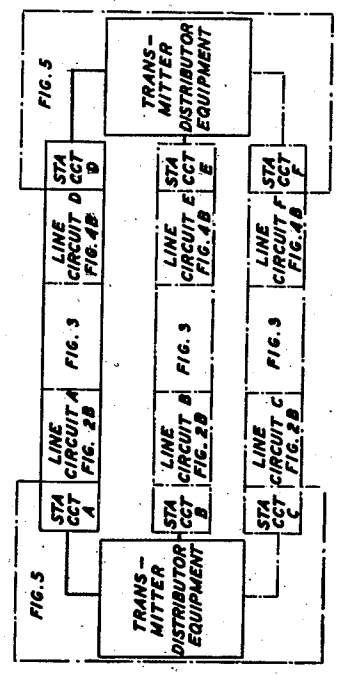
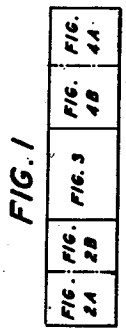
May 6, 1941. L. A. GARDNER ET AL 2,241,258

TELETYPEWRITER SWITCHING SYSTEM

Filed Sept. 15, 1938 4 Sheets-Sheet 1







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TELETYPEWRITER SWITCHING SYSTEM

Filed Sept. 15, 1938 4 Sheets-Sheet 2

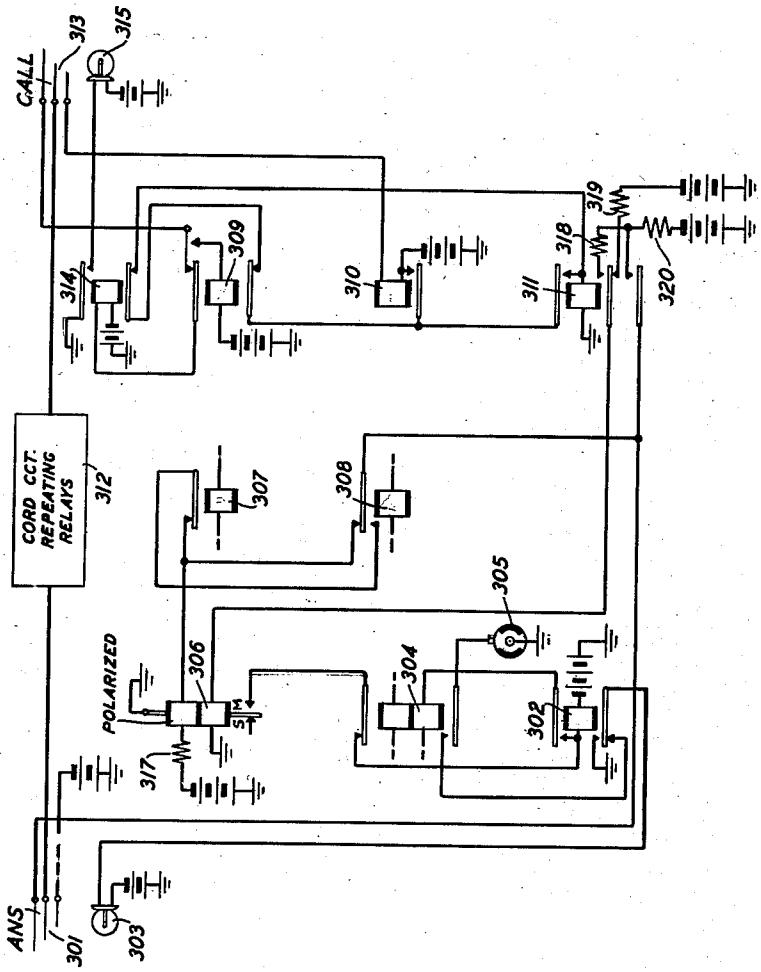

FIG. 3

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TELETYPEWRITER SWITCHING SYSTEM

Filed Sept. 15, 1938 4 Sheets-Sheet 3

FIG. 4A

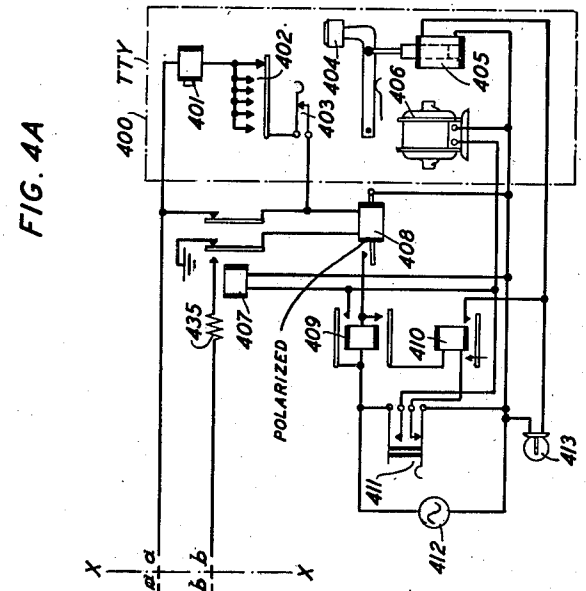
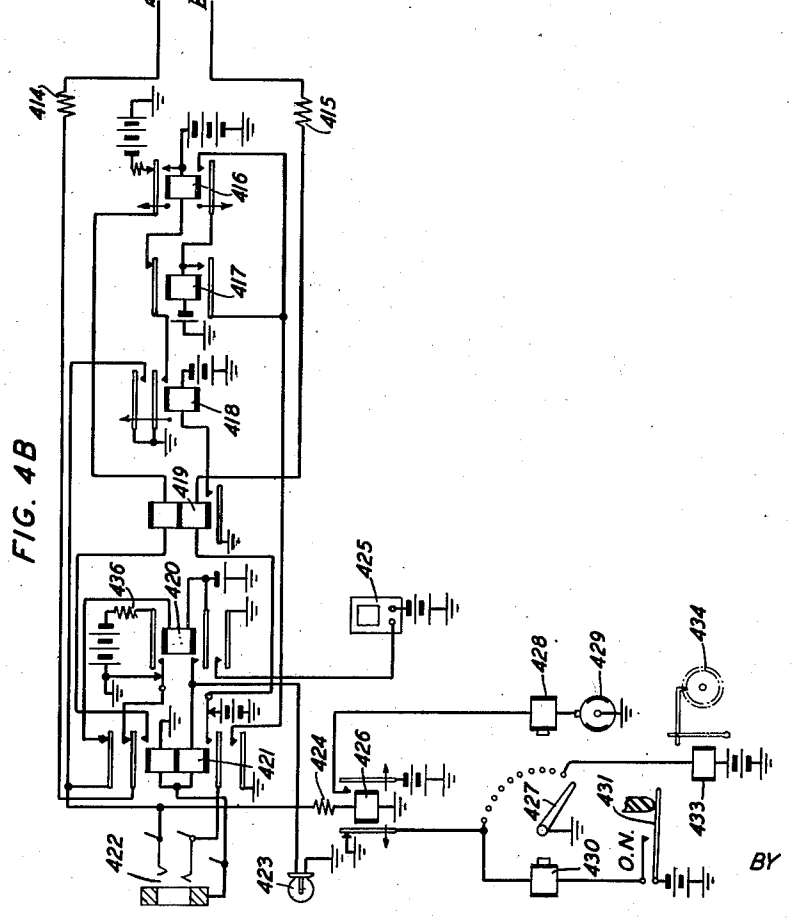


FIG. 4B



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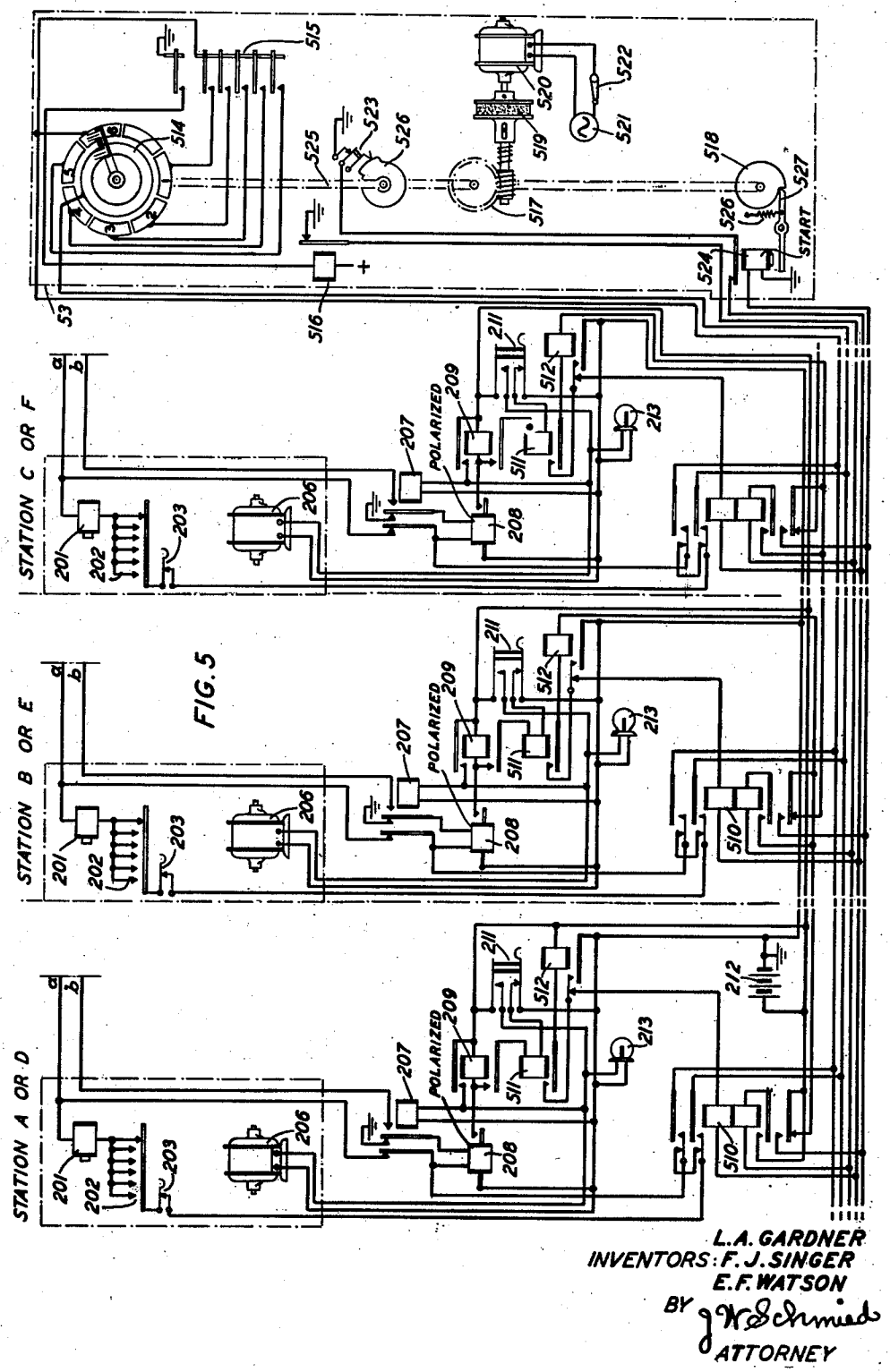

FIG. 5

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2,241,258

UNITED STATES PATENT OFFICE

2,241,258

TELETYPEWRITER SWITCHING SYSTEM

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Application September 15, 1938, Serial No. 229,984

9 Claims. (Cl. 178—2)

This invention relates to manual telegraph switching systems and more specifically provides an inexpensive manual teletypewriter switching system in which the necessary operator's functions in handling a call at the manual switching office are reduced to a minimum. In this system the only service required of an operator is to connect and disconnect the calling and called parties. In this system the called station teletypewriter motor is automatically started without the necessity of any operation by the central station operator other than inserting the plug of a cord in the called station jack. It is not necessary to perform any additional operation such as operating a key. A called station identifying signal is transmitted to the calling party, to assure the calling party that the connection is properly established. Further, the duration of the call is automatically timed.

It is generally understood by those familiar with telephone and teletypewriter switching systems' operation, that in deciding whether manual or mechanical switching offices should be used to handle traffic, the load which a single operator can handle satisfactorily in the operation of a manual board is a vital factor. This load may be increased as the operations required in handling a call are reduced. But as the operator's functions are reduced, automatic means for performing the operator's eliminated functions must be incorporated in the circuits, if the service is to be reliable and the subscriber is to be properly charged. Further, these automatic facilities should be simple and inexpensive, for as they become elaborate and costly, their initial cost and the cost of their maintenance approaches that of a full automatic switching system.

In this invention by providing called station identification signals to the calling subscriber, the necessity of monitoring a call by the central station operator, to insure that the calling party is connected to the desired party, is eliminated. By providing for automatic starting of called station apparatus, another operator function is eliminated. By providing automatic call-duration timing, yet another of the operator's functions is eliminated. In eliminating all three of the functions there remains only the necessity of connecting and disconnecting the subscribers. The invention herein resides in devising circuits in which all three of the eliminated functions are performed automatically and by means of simple, inexpensive apparatus.

It is an object of this invention to reduce the operations required by a central office operator in establishing a connection in a manual teletypewriter switching system to a minimum.

It is a further object of this invention to eliminate an operation now performed by the central station operator in starting all known teletypewriter remote control circuits in manual teletypewriter switching systems.

It is a further object of this invention to provide automatic call-duration timing in a manual teletypewriter switching system.

It is a further object of this invention to provide an automatic called station identification signal to a calling subscriber in a manual teletypewriter switching system in which call duration is automatically timed.

It is a further object of this invention to provide automatic called station teletypewriter motor starting, automatic called station identification to the calling subscriber, and automatic call-duration timing all in a single manual teletypewriter switching system.

It is a further object of this invention to provide simple, inexpensive apparatus to perform the three functions enumerated in the preceding paragraph.

A feature of this invention is a novel, inexpensive automatic call-duration timing device for a manual teletypewriter switching system.

A further feature of this invention is an inexpensive automatic called station identifying device, or answer-back device, as it is otherwise known in the art, for a manual teletypewriter switching system.

A further feature of this invention is an inexpensive relay controlled transmitting distributor common to a plurality of subscribers' lines at a particular business office, which may be used in sending back an identifying signal to a calling station.

A further feature of this invention is a device for controlling the connection of incoming calls to subscribers' offices wherein there are a plurality of teletypewriter receivers so that the incoming circuits are connected individually to a transmitting distributor which transmits station identifying signals to the calling subscriber in an ordered sequence.

Fig. 1 is a block diagram representing the interconnection of two subscribers' stations. This connection involves two lines, two stations, and one cord circuit. The station circuits are Figs. 2A and 4A which are identical electrically. The line circuits are 2B and 4B which are also identical electrically. The circuits are interconnected

by the cord circuit per Fig. 3. Figs. 2A and 4A include individual called station identifying signal apparatus or answer-back apparatus as it is otherwise generally known.

Fig. 1A is a block diagram also representing the interconnection of subscribers by means of cord circuits. The line circuits and cord circuits are the same as in Fig. 1. The called station identifying apparatus connected to the station circuits is different, however. In this arrangement the identifying apparatus is designed as a common source, located on the subscriber's premises. This common source of identifying signals will care for a number of station circuits on the premises. The station circuit and the common identifying apparatus for this condition are shown in Fig. 5. As represented therein and in Fig. 1A, the identifying apparatus is connected to three station circuits at each end of three telegraph paths, each comprising a cord circuit per Fig. 3 interconnecting a line circuit per Fig. 2B and a line circuit per Fig. 4B and two station circuits. The number of station circuits which may be served by a common identifying signal supply circuit per Fig. 5 is not limited to three, as the number may be increased to care for any number which may be used at a particular subscriber's location.

Fig. 2A shows a teletypewriter subscriber's station circuit. This station circuit, in addition to the usual receiving magnet, sending contacts and break key **201**, **202** and **203**, respectively, includes a relay **208**, operated by remote control, to start the operation of teletypewriter motor **206** by operating relay **209**, which closes the power circuit to the motor. It also includes relay **207** which operates to close the telegraph loop. The circuit includes also a manually operated switch **211** for starting and stopping the station motor locally. In addition to this apparatus, the station circuit includes a slow-to-operate relay **210**, which operates when the station circuit responds to remote control and in turn operates solenoid **205** which actuated a key in the station transmitter to send an identifying signal to the calling subscriber. Lamp **213** when lighted is a signal to the attendant at the subscriber's station that a call is incoming to the station.

Fig. 2B is a well-known line circuit which has been improved in accordance with this invention to include the call-duration timing apparatus and means to start a station circuit remotely, automatically. That is to say, on establishing a connection, through a cord to such a line circuit, it is not necessary to operate a key to start the apparatus at the station, as is the case with other presently known line and cord circuits.

The timing apparatus comprises relay **226**, selector switch **227** and its associated rotary and release magnets **228** and **230** and switch off-normal contacts **231**. The message register magnet and indicator **233** and **234**, respectively, are also parts of the timing apparatus.

Relay **216** in Fig. 2B operates, upon the establishing of a connection to the line circuit, to reverse the battery through polarized relay **206** to close the loop circuit.

Fig. 3 is a well-known cord circuit used in inter-connecting two subscribers through their line and station circuits. This circuit contains relays and resistances which have been added in accordance with this invention to cooperate with the call-duration timing feature included in this invention.

Figs. 4A and 4B show a teletypewriter subscriber's station and line circuit. They are identical in every respect with Figs. 2A and 2B, except that they are drawn in reverse to facilitate visualization of a connection with another subscriber's line and station circuit per Figs. 2A and 2B.

Fig. 5 shows a called station identifying apparatus common to a plurality of station circuits. Three of these station circuits designated A, B and C, are considered as being located on one subscriber's premises, and three others, D, E and F, are considered as being located at another subscriber's premises as indicated in Fig. 1A. The stations are identical. The station circuit connects to a line circuit per Fig. 2B or 4B as is also shown in Fig. 1A.

We are concerned herein with improved and added means of reducing the operator's functions so that an operator's work in handling a connection may be reduced.

These features have been incorporated into circuits well known in the art which otherwise remain unchanged. It is not thought necessary to an understanding of this invention to describe in detail the unchanged circuit functions and they will not therefore be described herein.

The detailed operation of the circuits involved in a connection per Fig. 1 will now be described in so far as it is necessary to an understanding of this invention.

Refer now to Figs. 2A and 2B. When the circuit is in the normal condition current flows, from battery, through the winding of relay **220**, the top, outer, back contact and armature of relay **221**, which is released, resistance **224** and relay winding **226** to ground. This current is insufficient to operate either relay.

When an attendant at the subscriber's station wishes to call another subscriber, the power switch **211** is operated so that its top armature engages its front contact. At the same time the circuit through the bottom armature and its back contact, which forms part of the remote control circuit to be explained in detail hereinafter, is broken. When the top armature of switch **211** engages its front contact, a circuit is closed, from one side of the power source **212**, through the top armature and front contact of switch **211**, through motor **206** to the opposite side of power source **212**, starting the motor.

The closing of switch **211** also establishes a circuit through the winding of relay **207** in parallel with the path through motor **206**. Relay **207** is operated, which closes the subscriber's loop by breaking the tip conductor of the loop from ground through the left-hand, inner, back contact and armature of relay **207** and connecting the tip and ring loop conductors together through the same armature and its front contact. The operation of relay **207** further opens a path short-circuiting the station printer equipment through the left-hand, outer armature and back contact of relay **207**. This short circuit protects the station equipment, while it is in the idle condition, and insures the operation of relay **208** under adverse conditions when the station is called.

When the tip and ring conductors of the loop are connected, a circuit may be traced from ground, through the break contacts of the make-before-break combination of relay **220**, the top, inner, back contact and armature of relay **221**, resistance **214**, receiving magnet **201**, transmitting contacts **202**, break key **203**, relay winding **208**,

the left-hand, inner armature and front contact of relay 207, resistances 235 and 215, the bottom winding of relay 219, the bottom, inner, back and front contacts of the make-before-break combination of relay 221 to positive battery. Relay 219 is operated. The operation of relay 219 in turn operates relay 218 over an obvious circuit. Relay 218 closes a circuit, from ground, through its top, outer armature and front contact, the top, outer armature and back contact of relay 221, the winding of relay 220 to battery, operating relay 220. The operation of relay 218 also established a circuit from ground, through its top, inner armature and front contact, the top armature and back contact of relay 217 and the winding of relay 216 to battery, operating relay 216. Relay 216 operated performs no useful function at this time. Relay 220 operated closes a circuit from battery, through its bottom, inner armature and front contact and the filament of lamp 223 to ground, lighting the lamp. Relay 220 operated also closes a circuit, through its bottom, outer armature and front contact and night alarm 225 to battery, operating the night alarm. A switch, not shown, is ordinarily connected in series with the night alarm so that it may be disconnected when not required. The operation of relay 220 further transfers the termination of the loop tip conductor, from ground to negative battery, through resistance 236 and the top armature and front contact of the make-before-break combination of relay 220. Relay 221 remains unoperated when relay 220 operates. We therefore have positive battery connected to one end of the loop in series with negative battery at the other end through the bottom winding of relay 219, holding relay 219 operated.

The operator, in response to the calling signal, inserts plug 301 of her cord circuit per Fig. 3 into jack 222.

The cord circuit per Fig. 3 is a modification of a cord circuit well known in the art. It is shown in more detail and its operation is more fully described in Patent 2,073,468 to K. E. Fitch issued March 9, 1937 and in the copending application of J. M. Desmond, Serial No. 200,542 filed April 6, 1938. It is not thought necessary to show it in full, or describe its operation completely in detail herein, and only so much of it is shown and so much of its operation is described as is necessary to an understanding of the present invention.

When plug 301 is inserted in jack 222 the tip, ring and sleeve connections of the jack are extended through the tip, ring and sleeve connections of the plug. The ring connection extends through various relay windings and contacts, including the operator's position equipment, all of which are not shown, to the single line repeater equipment 312 which functions in a well-known manner. The sleeve connection likewise extends, through various windings and contacts not shown, with the operation of which we are not concerned, to terminate in negative battery. Of the apparatus shown in the cord circuit, relays 302, 304, 307, 308, 309, 310 and 314 are relays presently used in the cord and readily identifiable by one skilled in the art from the description in the above-listed patent and application. They correspond respectively with relays 435, 433, 427, 506, 520, 511 and 512 of the above-mentioned application per Serial No. 209,542. Relays 306 and 311 and resistances 317, 318, 319 and 320 are added per this invention and the cord circuit is modified as indicated in Fig. 3.

Relay 221 of Fig. 2B is operated over a circuit, from battery on the sleeve of plug 301, through the sleeve of jack 222 and the top winding of relay 221 to ground. The operation of relay 221 breaks the circuit through the winding of relay 220 at the top, outer, back contact and armature of relay 221, releasing relay 220 and extinguishing lamp 223. The operation of relay 221 also connects ground through its bottom, outer armature and front contact, the bottom, front contact and armature of relay 216, through the winding of relay 217 to battery, operating relay 217. Relay 217 operated locks to this same ground, through its bottom armature and front contact. Relay 217 operated breaks the circuit through the winding of relay 216, which releases. The operation of relay 221 further transfers the termination of the tip of the subscriber's loop, from negative battery, from the top armature and front contact of relay 220, through its top, inner armature and back contact, to a circuit extending from the same armature and its associated front contact, through the top winding of relay 219, and the armature and back contact of relay 216 to negative battery. The operation of relay 221 also breaks the termination of the ring side of the subscriber's loop from positive battery, through the front and back contacts of the make-before-break combination associated with its bottom, inner armature and extends the ring circuit through said armature, the rings of jack 222 and plug 301 to positive battery, not shown, in the cord repeating relays. The effect of the current flowing through both windings of relay 219 is such that the relay is released, removing ground from the circuit through relay 218, which releases, removing ground from the tip of the jack circuit.

After the plug of cord 301 is inserted in jack 222 a circuit may be traced from ground through the winding of relay 226, resistance 224, the tips of jack 222 and plug 301, the top armature and back contact of relay 306, through the top winding of relay 306 and resistance 317 to negative battery. A biasing circuit for relay 306 may also be traced, from ground through the bottom winding of relay 306, the bottom, inner armature and back contact of relay 311, and resistance 319 to negative battery. The relative values of the batteries and resistances in these circuits are such that the effect of the current through the bottom winding of relay 306 is dominant and the armature remains in engagement with its left-hand or spacing contact. The current flowing through the relay 226, which controls the timing operation, is insufficient to operate it so that timing cannot start.

After the operator has obtained the number of the called subscriber from the calling party in a well-known manner, she connects plug 313 to one of the multiple jacks 422 associated with the called line. The tip, ring and sleeve connections of the plug 313 are extended through the tip, ring and sleeve connections of jack 422. Relays 310 and 421 operate over a circuit from battery through relay 310 winding, the sleeves of plug 313 and jack 422, through the top winding of relay 421 to ground. When relay 421 is operated, the circuit through relay 420 is broken at its top, outer armature and back contact. The tip of the subscriber's loop circuit is transferred from the connection extending to ground at relay 420 through the top, inner armature and back contact of relay 421, to a connection to negative battery, extending through said armature and

front contact, the top winding of relay 419, through the armature and back contact of relay 416. The ring of the jack is extended through the bottom, inner armature and front contact of relay 421, the bottom winding of relay 419 and resistances 415 and 435 to the front contact associated with the right-hand, inner armature of relay 407 where it is open. When the tip of the subscriber's loop is extended to negative battery, a circuit is closed through resistance 414, the right-hand, outer armature and back contact of relay 407, winding of relay 408, through the right-hand, inner armature and back contact of relay 407, to ground. Relay 419 operates, but relay 408, which is polarized, does not operate. When relay 419 operates, relay 418 operates over an obvious circuit. Relay 418 connects ground to the tip of the jack, through its outer armature and front contact. It also supplies ground, through its top, inner armature and front contact, the top armature and back contact of relay 417, through the winding of relay 416 to positive battery, operating relay 416. Relay 416 operated, connects positive battery to the tip of the subscriber's loop, operating polarized relay 408. Relay 416 operated, also closes the circuit from ground through the bottom, outer armature and front contact of relay 421, through its bottom armature and front contact, to battery through the winding of relay 417. This breaks the circuit through the winding of relay 416, releasing it. Relay 417 locks through its bottom armature and front contact to the ground which operated it. The release of relay 416 removes positive battery from the tip of the subscriber's loop, and, now that relay 408 has operated, reconnects it again to negative battery. This releases relay 408.

When relay 408 was operated it operated relay 409, over a circuit, from the top of power source 412, through relay 409 winding, the armature and contact of relay 403, to the bottom of power source 412. Relay 409 operated, operates relay 407 and motor 406, over a circuit, from the top of power source 412, through the top armature and front contact of relay 409, through relay 407 and motor 406 in parallel, to the bottom of power source 412. Relay 409 operated, locks through its bottom armature and front contact, the winding of relay 410, the bottom armature and back contact of switch 411 to the bottom of power source 412. Relay 407 removes ground from the tip of the subscriber's loop at its right-hand, inner armature and establishes the subscriber's loop, by connecting said armature to its front contact. Relay 407 also breaks the short circuit around the station teletypewriter apparatus at its right-hand armature and back contact. Relay 410 connects power to solenoid 405 and lamp 413 in parallel. The solenoid in turn operates key 404 on the station transmitter. This sends a signal identifying the called station to the calling station. The circuit per Fig. 2A is now in a condition to receive, and a message may be received without operating switch 211. The station operator, in response to the lighted lamp signal can operate key 411 to its alternate position. This releases relay 410 which in turn extinguishes lamp 413 and deenergizes solenoid 405 which releases key 404. Operation of switch 411 also breaks the holding path through relay 409 which releases and provides a path to hold relay 407 and motor 206 in operation. It also provides a path to maintain the motor in operation. Relay 407 is held operated which holds the subscriber's loop closed. The circuit is now conditioned to either receive or transmit.

When the subscriber's loop is established, current is supplied to both windings of relay 419 which neutralize the effect, each of the other, and the relay releases. Relay 419, we have seen supplied ground, while operated, for the operation of relay 418. During the interval that relay 418 is operated ground was connected to the tip of jack 222. When the station teletypewriter apparatus was started and the loop closed, as a result of the release of relay 419 and in turn 418, the ground on the tip of the jack 422 and cord 313 is removed. This controls the operation of the timing apparatus as will now be described.

When ground was connected to the tip of the cord, through the top, outer armature and front contact of relay 418, a circuit was established, through the tips of jack 422 and plug 313, the top armature and back contact of relay 309, through the winding of relay 314, operating relay 314. This momentarily lights lamp 315 over an obvious circuit as a signal that the called station has not yet responded. It also opens the circuit from battery through the front contact and armature of relay 310, which is operated, the bottom armature and back contact of relay 309, through the bottom armature and back contact of relay 314, through the winding of relay 311 to ground. When, after the called station apparatus responds, ground is removed, as we have seen, at relay 418, relay 314 releases, extinguishing lamp 315 and operating relay 311, over the circuit last traced. Relay 311 operated, locks through its top armature and front contact to the battery supplied by the operation of relay 310.

The operation of relay 311 increases the current through relay 226 in Fig. 2B by connecting resistance 320 through its bottom, outer armature and front contact in parallel with the path through the top winding of relay 306, heretofore traced. Relay 226 operates on the increased current to start the operation of the timing mechanism to be described in detail hereinafter.

The operation of relay 311, by connecting a resistance in parallel with the top winding of relay 306 to increase the current through relay 226, decreased the current through the top winding of relay 306. Since it is necessary to maintain the armature of relay 306 from engagement with its right-hand contact, to prevent the reception of a supervisiory signal on the answering side of the cord, the current through the bottom or biasing winding of relay 306, the effect of which is to tend to operate the armature of relay 306 engage its right-hand contact, must be correspondingly reduced. This is effected by substituting resistance 318 in series with 320 for resistance 319, when the bottom, inner armature of relay 311 operates from its back to its front contact.

When relay 226 operates, it establishes a circuit from battery through its left-hand armature and front contact, through the winding of rotary drive magnet 228 and rotary interrupter 229 to ground. The rotary interrupter is power-driven at any desirable speed. It is arranged essentially to provide an interrupted ground supply for the intermittent operation of rotary magnet 228, which drives the arm of selector 227, so that it engages the associated contacts, indicated by small circles arranged in an arc, successively. The timing may be fixed in any desired manner. As arranged in the figure herein, when the arm

of the switch is stepped onto the first contact an obvious circuit is established to energize register magnet 233 which in turn operates register 234. The switch 227 is operated continuously while the circuits are conditioned for communication, stepping around to the last contact and then returning to the first, to repeat the cycle in a well-known manner. As the arm passes over the first contact in each cycle, the register is operated. While the arm is operated from the normal position, the off-normal springs 231 are in engagement, but the circuit through the switch release magnet 230 is disconnected from ground at the right-hand armature and contact of relay 226 which are open.

At the conclusion of communication the calling subscriber restores switch 211 to normal. This opens the circuit to the motor 206. It also releases relay 207, which opens the ring of the subscriber's loop circuit and grounds the tip. Ground on the tip shunts timing relay 226 which releases, deenergizing the rotary magnet 228 and operating the release magnet 230 associated with switch 227 which is restored to normal, stopping the timing mechanism.

Ground on the tip also increases the current through the top winding of relay 306, the effect of which now becomes dominant over the effect of the current in the bottom winding and the armature of relay 306 is actuated to the right to engage its right-hand contact. A circuit may now be traced from ground through the armature and right-hand contact of relay 306, the top armature and back contact of relay 304, through the winding of relay 302 to battery. Relay 302 operates, supplying ground through its bottom, front contact and armature to light lamp 303 as a disconnect signal to the operator who takes down the cord.

In the case of the called station the attendant may stop the station equipment and transmit a disconnect signal as follows.

For stations arranged per Fig. 4A where switch 411 has been operated in response to the calling signal after the called station identification signal has been transmitted, the station attendant restores key 411 to normal. Remembering that relays 409 and 410 were released when switch 411 was first operated to its alternate position, restoration of switch 411 to normal breaks the circuit through relay 407 at the top armature and front contact of switch 411. Relay 407 releases and grounds the tip of the subscriber's loop. The restoration of switch 411 opens the circuit for motor 406 at the same armature and contact of switch 411. Ground on the tip of the called line operates relay 314 over a circuit heretofore traced, lighting lamp 315 as a disconnect signal. The operator takes down the cord, releasing relay 310, which opens the holding path of relay 311 which releases, restoring the cord to normal.

The operation of the common identifying signal supply per Fig. 5 will now be described.

The station circuit apparatus other than the identifying signal supply equipment and its controlling relays is the same as the station circuit apparatus in Fig. 2. This is indicated by the numerals in the 200 series assigned to corresponding apparatus units in Fig. 2 and Fig. 5.

We will consider first a call incoming to station D of a group of three station circuits D, E and F on a particular subscriber's premises.

When relay 208 in Fig. 5 responds to remote control, relay 209 is also operated over a circuit from the positive terminal of battery 212, through the winding of relay 209, the contact and armature of relay 208, to the negative terminal of battery 212. Relay 209 when operated connects power to the motor 206 through its top armature and front contact and locks, over a path from positive terminal of battery 212, through relay 209 winding, the front contact and armature of relay 209, the winding of relay 511, the bottom, back contact and armature of switch 211 to the negative terminal of battery 212. Relay 511 is operated. The operation of relay 209 also closed a path for the operation of relay 207, from the positive terminal of battery 212, through the top armature and front contact of relay 209, the winding of relay 207 to the negative terminal of battery 212.

The operation of relay 207 closes the subscriber's loop circuit and removes the short circuit from the station equipment as heretofore described. The operation of relay 511 closes a circuit for the operation of relays 512 and 510 from the positive side of battery 212, through the winding of relay 512, the armature and front contact of relay 511, the front and back contacts of the make-before-break combination on relay 512, the top, or operate, winding of relay 510, through the top, back contact and armature of relay 524 and the contacts 523 associated with cam 526, fixedly mounted on shaft 525, to ground. Cam 526 operates contacts 523 into engagement only when the shaft 525 is in the position corresponding to the position in which the arm of the distributor is in engagement with segment 6 of 514. Relay 512 is made slow to operate to insure the operation of relay 510, as when relay 512 operates, it opens the operating path of relay 510 and locks from the negative or grounded side of the battery 212, through the armatures and contacts of relays 512 and 511 in series, relay 512 winding, to the positive side of the battery 212. Relay 510 operated, closes a holding circuit from the positive side of battery 212, through the bottom, inner, front contact and armature of relay 510, through the bottom winding of relay 510, to ground through the armature and back contact of relay 516, which is normally released. Relay 510 operated, opens the circuit through the back and front contacts of its two make-before-break combinations, which normally connect the subscriber's loop in series through the contacts of this relay and substitutes the two-wire connection to the transmitter-distributor. Relay 510 operated, energizes the start magnet 524 of the distributor, from the positive terminal of battery 212 through the bottom, outer armature and front contact of relay 510, through magnet 524 to ground. The operation of magnet 524 breaks the connection to ground through contacts 523 which operated relay 510 and also operates a lever 527, unlocking cam 518, which permits the transmitter-distributor shaft 525 to revolve under the influence of worm gears 517, friction clutch 519 and motor 520, driven by power source 521. These are parts of the transmitter-distributor mechanism whose operation is well known. The operation of the transmitter-distributor translates the combination perforated in a tape, through the medium of a group of tongues and contacts 515, into electric impulses, which are impressed on the line successively by the commutator-distributor device 514 as the distributor arm passes over the segments of the commutator. The transmitter-distributor will continue to operate until the tape reaches a position in which the sixth hole is perforated. At

this point ground will be connected to the winding of relay 516. Relay 516 will operate, breaking the ground connection through the bottom or holding winding of relay 510 which releases. The release of relay 510, in turn, deenergizes magnet 524 which allows the lever 527 to be restored to its original position under the influence of spring 526. The release of magnet 524 stops the revolution of the cam 518 by engagement between the right-hand end of said lever and a raised surface on the periphery of the cam. The revolution of shaft 525 and the arm of the transmitter-distributor keyed to said shaft is likewise stopped as the driven member of friction clutch 519 is held. When the revolution of the shaft stops, ground is furnished again to the operate winding of relay 510 through contacts 523, but as the circuit through this winding is open at relay 512, which is operated, relay 510 remains released. Relay 510, released, disconnects the leads to the transmitter-distributor from the station circuit and reestablishes the original station circuit loop connection in series through the contacts of relay 510.

The operation of the circuit per Fig. 5 has been described for a call assumed to be incoming to station D. We will now describe a call incoming to station F, and assume that station D is connected to the transmitter-distributor and that station B is also awaiting its turn for connection to the transmitter-distributor apparatus.

Since the transmitter-distributor is operating for the connection to station D, relay 510 associated with station D is operated. Relays 511 in the E and F station circuits are operated. With relay 510 operated, relays 512 in the E and F station circuits cannot operate, as the connection to positive battery 212, through the windings of relays 512 is broken at the bottom, outer, back contact of relay 510 of station D. When relay 510 of station D releases, at the end of the transmission of the identifying signals, a circuit may be traced from the positive terminal of battery 212, through the armature and back contact of relay 510 of station D, the winding of relay 512 of station E, the armature and front contact of relay 511 of station E, the front and back contacts of the make-before-break combination of relay 512 of station E, through the top or operate winding of relay 510 of station E, the top, back contact and armature of relay 524, to ground, through contacts 523, operating relays 512 and 510 in station E. These relays lock as in the case of station D. When relay 510 in station E operates, the connection to the positive side of battery 212 in station D, which is necessary for the operation of relay 512 in station F, is broken at the bottom, outer armature and back contact of relay 510 in station E. Relay 512 in station F cannot operate, therefore, until both relays 510 in stations D and E are released.

If any relay 511 in a station circuit operates, due to an incoming call, while another station is connected to the transmitter-distributor, its associated relay 510 cannot operate to connect it to the transmitter-distributor, because ground for the operate winding of its relay 510 will not be available in the distributor until the transmission of the identifying characters is ended and relay 524 releases to establish the connection to ground through contacts 523. Thus but one station may be connected to the transmitter-distributor at a time, and preference is given to the station, the operate winding of whose relay 510 is directly connected to the positive side of battery 212 and, thereafter, in a definite order to the stations, depending upon the relative positions of the operate winding of relay 510 of the particular station in the chain connection to the positive side of battery 212.

In the case of a station circuit arranged per Fig. 5, it may be observed, as in the case of circuits per Fig. 2A or 4A, it is not necessary to operate the station power switch in order to receive. In the case of Fig. 5, however, a called station may also transmit without operating the power switch. In the case of both arrangements, if the switch were left in the normal position while a message were being received, in order to stop the station equipment and signal the operator at the conclusion of communication, the attendant would operate switch 211, first downwardly, and then restore it to normal. Operation to the down position breaks the locking path through relays 209 and 210 in Fig. 2A or through 209 and 511 in Fig. 5, releasing the relays. The operation of the switch also connects the winding of relay 207 and motor 206 to positive battery to hold the subscriber's loop closed. When the switch is restored to normal, relay 207 is released and the motor is stopped.

As described above the operation of the timing of mechanism is stopped when the calling station power switch is operated. If it is desired to arrange the timing mechanism so that it may be stopped also by the called subscriber's first operating the power switch at the called station, before the calling subscriber's power switch is operated, the locking contacts for relay 311 are removed. Then when the called subscriber sends a disconnect signal relay 311 is released and the current through relay 226 is reduced so that the relay releases.

The features of this invention have been disclosed as applied to a cord circuit presently used and well known in the art. This cord circuit is at present used to interconnect other types of line circuits not including the automatic remote control feature shown in the line circuit herein. This new automatic remote control feature functions when a cord circuit is connected to a line circuit to start the station equipment. To do this it is not necessary to operate a key in the cord circuit as has heretofore been necessary. As modified, however, as shown in Fig. 3 the cord circuit will function with the existing well-known line circuits in the usual manner, so that, if it is desired, it will not be necessary to modify all existing line circuits in accordance with Fig. 2B. And until such time as they are modified, it would be possible by marking the jacks associated with the new lines, to indicate to the central station operator the lines on which it is unnecessary to perform the additional operation of operating a key to start a station by remote control. Further, the operator would know from these markings that it would not be necessary to spend time monitoring the connection to insure that the calling party was connected to the proper called party and further the operator would know that it was unnecessary to time the connection as the timing would be performed automatically.

What is claimed is:

1. In a manual teletypewriter switching system, a telegraph line and station circuit, a teletypewriter motor, a remote control device for starting said motor, a called station identifying device, and a call metering device all in said circuit and means whereby said devices are made re-

sponsive automatically to the connection of said circuit through a cord circuit to another line and station circuit.

2. In a manual teletypewriter switching system, a calling and a called local station, means in said system for establishing an operable telegraph channel connecting said stations, a teletypewriter motor at said called station, automatic motor starting means at said called station, automatic station identification means at said called station, communication time metering means connected to said channel, a first remote control means connected to said channel for operating said starting means in response to the insertion of a plug in a jack both in said system, a second remote control means connected to said channel for operating said station identification means in response to said insertion and a third automatic remote control means also connected to said channel for starting said metering means upon the establishing of said channel.

3. In a telegraph circuit, a first local telegraph station, a second local telegraph station, an operable telegraph channel connecting said stations comprising a cord circuit having a plug therein, an answer-back device at one of said stations responsive to automatic control means connected to said channel to transmit an identifying signal to the other of said stations and a metering device connected to said channel responsive to automatic control means connected to said channel for measuring the period of communication between said stations.

4. In a teletypewriter circuit, a calling teletypewriter station, a called teletypewriter station, a telegraph circuit connecting said stations comprising a manually operated cord circuit, means in said telegraph circuit for transmitting a signal characteristic of said called station to said calling station, means in said telegraph circuit for measuring elapsed communication time, means also in said circuit for initiating the operation of said identifying device responsive to control means operated by connecting said cord circuit to said called line and automatic means for starting said measuring device responsive to control means operating when said telegraph circuit is conditioned for communication.

5. In a manual teletypewriter switching system, a central switching station, a plurality of local stations, a plurality of telegraph circuits connecting each local station with said central station, a called station identifying device, located in close proximity to said local stations, common to said local stations and means for connecting said device individually to any one of said telegraph circuits.

6. In a manual teletypewriter switching system, a subscriber's line and station circuit, a cord circuit conditioned to cooperate with said circuit, a plug in said cord circuit, automatic teletypewriter starting apparatus in said station circuit, automatic teletypewriter starting control means in said line circuit responsive to the connection of said plug to said line circuit to start said teletypewriter apparatus.

7. In a manual teletypewriter switching system, a subscriber's line circuit and a station circuit means for interconnecting said circuits, teletypewriter remote control starting means in said station circuit, a polar relay in said station circuit responsive only to current of a definite polarity to initiate the operation of said starting means, and means in said line circuit, responsive to the connection of a cord circuit to said line circuit, for supplying directly from said line circuit current of said polarity.

8. In a manual teletypewriter switching system, a line circuit, a station circuit, teletypewriter motor starting means in said station circuit, a telegraph loop circuit having a first and a second end interconnecting said circuits, means in said line circuit for connecting telegraph transmitting battery of a first polarity directly to said first end and means also in said line circuit, responsive to the connection of a cord circuit to said line circuit, for connecting battery of a polarity opposite from said first polarity directly to said first end to operate said teletypewriter starting means.

9. In a manual teletypewriter switching system, a calling and a called teletypewriter station, means in said system for establishing an operable telegraph path connecting said stations, a teletypewriter at said called station, automatic starting means for said teletypewriter at said called station, automatic called station identifying means connected to said path for identifying said called station, automatic communication time metering means connected to said path for measuring the time said path is conditioned for communication, flexible, manually operated means in said system for extending said path toward said called station as said path is being established, means in said path, reponsive to the extension of said path by said flexible means, for operating said starting means, means in said path, responsive to the extension of said path by said flexible means for operating said identifying means, and means in said path responsive to the establishment of said path for operating said metering means.

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